



hp calculators

HP 35s Converting programs
to line number addressing

Programming the HP 35s

Using line numbers rather than labels

Example



Programming the HP 35s

Doing a simple calculation once on the HP 35s is easy. Doing the same calculation many times, or doing a complicated calculation, takes longer. It can be better to store all the steps needed for the calculation in a **program**. A program is a set of instructions, stored all together. Once it is written, it can be tested to see if it works correctly. Then it can be used many times, without the need to press every key of the calculation each time.

A simple program is just a set of keystrokes stored so that they can be carried out with one key. The HP 35s provides many commands to let programs do more, for example stop and ask for input, or show an intermediate result.

This training aid concentrates on converting programs originally written using labels, such as programs written for the HP33s, to using line number addressing, as is available on the HP 35s calculator.

Converting programs from labels to line numbers

The HP 35s has 26 labels for use to define programs or transfers to locations within programs. Unlike the HP 33s, the HP 35s also includes the ability to transfer execution to specific line numbers within one of the 26 labels. This allows for a much greater utilization of program memory without using labels excessively.

Suppose you have the program below and wish to convert it to the HP35s. This program will pause to display the intermediate values, given a whole number input, as it performs the steps involved in Ulam's Conjecture. Will the number eventually converge to one or not? (Note: There has been absolutely no attempt to optimize this program!)

	Label Version
A001	LBL A
A002	STO A
B001	LBL B
B002	PSE
B003	1
B004	$x=y?$
B005	RTN
B006	$x<>y$
B007	2
B008	RMDR
B009	$x=0?$
B010	GTO D

B011	RCL A
B012	3
B013	x
B014	1
B015	+
C001	LBL C
C002	STO A
C003	GTO B
D001	LBL D
D002	RCL A
D003	2
D004	INT ÷
D005	GTO C

Converting on paper. Given the initial listing, the first suggestion is to make a note next to the first step following each LBL instruction after the initial label that starts the routine. These would be the PSE after LBL B, the STO A after LBL C, the RCL A after LBL D. Beside each of these steps, write B, C, and D. These will become the steps that line number GTOs and XEQs will reference. In the listing below, these steps are **BOLD**.

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	Label Version
A001	LBL A
A002	STO A
B001	LBL B
B002	PSE
B003	1
B004	x=y?
B005	RTN
B006	x<>y
B007	2
B008	RMDR
B009	x=0?
B010	GTO D

B011	RCL A
B012	3
B013	x
B014	1
B015	+
C001	LBL C
C002	STO A
C003	GTO B
D001	LBL D
D002	RCL A
D003	2
D004	INT ÷
D005	GTO C

Now, write the program down again, but this time leave out all LBL instructions – but put the LBL letter next to the instruction that follows the now deleted label. Also leave in the GTO (or XEQ) instructions with the labels originally referenced. This may make it easier to replace them with the proper line number addresses.

With	Line Numbers
	LBL A
	STO A
B	PSE
	1
	x=y?
	RTN
	X<>Y
	2
	RMDR
	x=0?
	GTO D

	RCL A
	3
	X
	1
	+
C	STO A
	GTO B
D	RCL A
	2
	INT ÷
	GTO C

Now begin numbering the lines starting with A001. When you get to a line with a letter next to it, find the GTO or XEQ instruction with that same letter. Change that GTO or XEQ instruction to point to the line number of the instruction that had the letter next to it. Line A003 is the first one encountered.

With	Line Numbers
A001	LBL A
A002	STO A
B	PSE
	1
	x=y?
	RTN
	X<>Y
	2
	RMDR
	x=0?
	GTO D

	RCL A
	3
	X
	1
	+
C	STO A
	GTO A003 **Changed**
D	RCL A
	2
	INT ÷
	GTO C

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Continue working through the program in this manner. Line A017 is the next one. Then line A019.

With	Line Numbers
A001	LBL A
A002	STO A
A003	PSE
A004	1
A005	x=y?
A006	RTN
A007	X<>Y
A008	2
A009	RMDR
A010	x=0?
A011	GTO D

A012	RCL A
A013	3
A014	X
A015	1
A016	+
A017	STO A
	GTO A003
D	RCL A
	2
	INT ÷
	GTO A017
	Changed

With	Line Numbers
A001	LBL A
A002	STO A
A003	PSE
A004	1
A005	x=y?
A006	RTN
A007	X<>Y
A008	2
A009	RMDR
A010	x=0?
A011	GTO A019
	Changed

A012	RCL A
A013	3
A014	X
A015	1
A016	+
A017	STO A
A018	GTO A003
A019	RCL A
	2
	INT ÷
	GTO A017

The final version of the program would look like this:

With	Line Numbers
A001	LBL A
A002	STO A
A003	PSE
A004	1
A005	x=y?
A006	RTN
A007	X<>Y
A008	2
A009	RMDR
A010	x=0?
A011	GTO A019

A012	RCL A
A013	3
A014	X
A015	1
A016	+
A017	STO A
A018	GTO A003
A019	RCL A
A020	2
A021	INT ÷
A022	GTO A017

Conclusion. While there are many ways of converting programs containing labels to use line numbers, this is one example. Line number addressing provides many benefits on the HP 35s.